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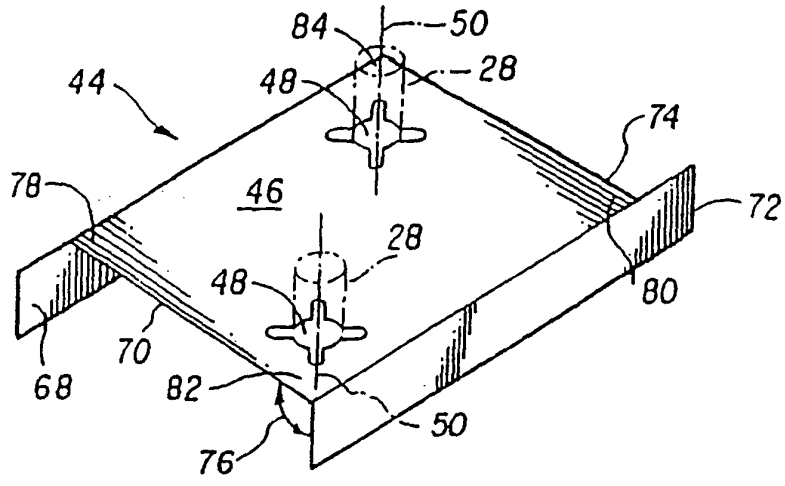

(57) Abstract

A gas discharge lamp, such as, for example, a high pressure sodium lamp having a base and sealed outer envelope connected thereto. At least one arc tube is provided within the outer envelope and is electrically and mechanically connected to a support frame. Lead-in connectors (28) extend into the outer envelope to electrically connect the lamp base to the support frame. A connecting member (44) is connected to the arc tube lead(s) furtherest from the lamp base for effecting a weldless electrical and mechanical interference fit between such lead(s) and the connecting member and for preventing axial and radial movement of such lead(s) relative to the connecting member. The connecting member is electrically and mechanically connected to the support frame.

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MECHANICAL SUPPORT AND ELECTRICAL CONNECTOR FOR A GAS DISCHARGE LAMP

1. Field of the Invention

The present invention relates to a single or twin arc tube discharge lamp such as, for example, a high pressure sodium discharge lamp including an arc tube support member which provides a secure mechanical and electrical connection in the form of an interference fit between the mechanical support member and the conductive portion of the arc tube(s).

2. Description of the Prior Art

The present invention will be described herein in the context of a gas discharge lamp having two arc tubes sealed within an outer envelope. However, the scope of the present invention is not limited to such lamps but also covers gas discharge lamps having one or more arc tubes sealed within an outer envelope. In other words, the present invention relates to an arc tube support member which can be altered within the teachings of the present invention for use with one or more arc tubes, depending upon the nature of the lamp.

The use of a gas discharge lamp having a single arc tube is well known in the art. One significant disadvantage of the single arc tube-type gas discharge lamp is that if power to the lamp is momentarily interrupted, the lamp discharge will be extinguished, and it will not be re-initiated until the lamp cools off and the pressure therein is reduced. After the discharge tube is re-ignited, the lamp must warm-up again before the full lamp output can be achieved. Over the past several years efforts have

been made to overcome these problems by providing a gas discharge lamp having two arc tubes. One example has been the introduction of twin tube high pressure sodium lamps. The inclusion of the second arc tube provides almost instantaneous restart after a power outage with a significant fraction of design light output generated. Early applications of twin arc tube high pressure sodium lamps were for standby lighting in industrial, commercial and other interior public spaces. More recent applications have included roadway and other outdoor lighting uses. In each instance, an important consideration has been the increased reliability of the lamp resulting from the partially redundant features of the standby arc tube. Initial use in various indoor applications subjected the twin arc tube lamps to a relatively permissive environment. However, the use of such lamps in outdoor applications has exposed the twin arc tube lamps to much more stringent electro-mechanical requirements. One of the problems encountered is that it has been difficult to maintain the arc tubes parallel to and uniformly separated from each other. When considering long term lamp performance, it is preferable to mount the paired arc tubes orthogonal to the plane of the support frame, and in such constructions it has also been difficult heretofore to maintain the perpendicularity of the arc tubes. Another problem that has been encountered is that it has been difficult to maintain the support assembly in the major axis of the lamp and parallel thereto.

The foregoing problems relate to the orientation of the arc tubes. Another problem has resulted from the use of a welded refractory wire metal member as a structural element in the lamp. For example, in U.S. Patent No. 4,689,518 to King, which issued on August 25, 1987, twin tubes are supported by a wire frame formed of several pieces and welded together to support the discharge tubes centrally within the outer envelope by means of a spring clip which is welded atop the support frame and engages a dimple formed in the top of the envelope.

Another embodiment is disclosed in U.S. Patent No. 4,287,454 to Feuersanger et al, which issued on September 1, 1981, and is assigned to the same assignee as this invention. In this patent, a twin tube lamp is shown. Upon initial application of power to the parallel-connected arc tubes, one will start and operate normally, while the second tube will remain unlighted, ready for an immediate restart in the event of an interruption in the power supply. The twin lamps are supported within the outer glass envelope by a support frame to which electrode centering rods are spot welded near the dome of the outer envelope to provide mechanical support. Electrical connection is made by welding a lead to the support frame and to the electrode.

A more recent design employs a formed niobium wire which is looped around the sealing/electrical inlead assembly of each arc tube at the dome end of the lamp. The looped lead is welded to

each arc tube assembly and to the support frame.

In U.S. Patent No. 4,401,913 to Koza et al., which issued on August 30, 1983, to the same assignee as the present invention, the arc tube centering problem is addressed with a spring-like upper support member held in place by a dimple formed in the top of the outer glass envelope. This particular design is not applicable to a twin tube lamp. In addition, as in the foregoing prior art structures the electrical leads are welded.

In U.S. Patent No. 3,094,640 to Gustin, which issued on June 18, 1963, a stamped sheet metal frame is used in place of the prior art welded wire frame, minimizing the number of welds needed. However, this particular design mounts an arc discharge tube at its pinched-end seal and still requires welding of the lead-in wires.

The complexity and unreliability of the welded wire support frame are detailed in U.S. Patent No. 2,951,959 to Fraser et al., which issued on September 6, 1960. The improvement offered in this patent is a sheet metal frame similar to that described in the '640 patent to Gustin wherein the arc tube seals are supported. However, as in the previous patents discussed the lead-ins are welded.

U.S. Patent No. 3,250,934 to Peterson, which issued on May 10, 1966, relates to another attempt to anchor the ends of an arc tube per se, this time by means of sheet metal plates. However, as

in other prior art, the lead-ins are welded to the standard wire frame.

A similar combination of sheet metal arc tube supports and a complex wire frame with the lead-in wires welded thereto is disclosed in U.S. Patent No. 2,749,462 to Kenty et al., which issued on June 5, 1956, and U.S. Patent No. 2,671,183 to St. Louis et al., which issued on March 2, 1954. It is readily obvious from these designs that complexity has not been reduced nor has reliability been improved over the basic welded wire frame.

Similarly in U.S. Patent No. 2,677,068 to Martt, which issued on April 27, 1954, sheet metal supports are provided for the pinch-sealed ends of an arc tube, but the lead-ins are welded to the wires which constitute the remainder of the support frame.

U.S. Patent No. 3,623,134 to Werner et al., which issued on November 23, 1971, describes an embodiment wherein a spring clip is welded to a support frame and to an arc tube lead-in. In an alternative embodiment, a pin or rod extends from the upper end enclosure of an arc tube and extends through an aperture in a rigid bar which is welded to upstanding legs of a frame, the pin or rod being slidably received in the aperture to permit axial expansion of the arc tube during use. In this embodiment, electrical connection between the arc tube and frame is by means of a flexible electrically conductive strap which is welded to the pin and to the support frame.

Each of the foregoing structures is subject to failure at

the welded areas when exposed to shock and vibration conditions, particularly those lamps associated with outdoor use. In addition, the problems discussed above regarding the proper arc tube and support assembly orientation, especially in twin arc tube lamps, continues to be a concern. The present invention addresses all of the various problems set forth above, overcoming the deficiencies of the prior art and providing an arc tube support means which functions equally well for both single and twin arc tube lamps.

SUMMARY OF THE INVENTION

This invention achieves these and other results by providing a gas discharge lamp, comprising a base and a sealed outer envelope connected to the base. A pair of lead-in conductors extend from the base into the sealed envelope. At least one arc tube is disposed within the sealed outer envelope. Each arc tube has a first lead electrically connected to one lead-in conductor and a second lead. A support frame extends into the sealed outer envelope and includes a first segment electrically connected to another lead-in conductor and an opposite second segment. Connecting means is connected to each second lead for effecting a weldless electrical and mechanical interference fit between each second lead and the connecting means and for preventing axial and radial movement of each second lead relative to the connecting means. The connecting means is also electrically and mechanically connected to the opposite second segment of the support frame.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a partial cross-sectional view of a gas discharge lamp of the present invention;

Figure 2 is a perspective view of a connecting means used in the gas discharge lamp of Figure 1;

Figure 3 is a plan view of a portion of the connecting means of Figure 2;

Figure 4 is a plan view of an alternative connecting means of the present invention;

Figure 5a is a plan view of yet another alternative connecting means of the present invention;

Figure 5b is an elevational view of the embodiment of Figure 5a; and

Figure 6 is a plan view of another alternative connecting means of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The embodiments of this invention which are illustrated in the drawings are particularly suited for achieving the objects of this invention. Figure 1 depicts a gas discharge lamp 2 such as a high pressure discharge lamp. An example of such a lamp is a high pressure sodium lamp. Other examples include, without limitation, high pressure mercury vapor and metal halide lamps. In the preferred embodiment two or more arc tubes are provided in a known manner as disclosed, for example, in the '454 patent discussed herein. However, the present invention is equally applicable to

single arc tube discharge lamps as discussed, for example, in the '134 and '913 patents discussed herein.

The twin arc tube high pressure sodium discharge lamp 2 depicted in Figure 1 includes a base 4 and a sealed outer envelope 6 connected thereto in the conventional manner. The outer envelope 6 is evacuated in the case of high pressure sodium discharge lamps and is made of a light transmitting substance. A conventional two conductor screw-type base 4 is operative to receive power from an external source (not shown) and to couple power through a lamp stem 8 by means of a pair of lead-in conductors 10 and 12 which extend from the base, through the stem and into the sealed envelope in a conventional manner.

In such a lamp at least one arc tube is disposed within the sealed outer envelope 6. In the embodiment depicted in Figure 1, two arc tubes 14 and 16 are disposed within the sealed outer envelope 6. Arc tubes 14 and 16 are supported in the envelope 6 by a U-shaped lower support frame 20 and an upper support frame 22. Each support frame is made of a conductive material and is operative not only to support the discharge tubes 14 and 16, but also to conduct power from the base 4 to the discharge tubes. Discharge tubes 14 and 16 are arranged side-by-side and parallel to each other and parallel to a lamp axis 24.

The high pressure sodium discharge arc tubes 14 and 16 typically include cylindrical tubes commonly made of ceramic light-transmitting material such as aluminum or yttria and have

electrodes sealed in opposite ends by known methods. The discharge tubes 14 and 16 have a fill material including an amalgam of sodium and mercury and an inert gas in the case of high pressure sodium lamps. Each arc tube 14 and 16 has a respective first lead 26 and a respective second lead 28. Each first lead 26 is electrically connected to lead-in conductor 12. For example, in the embodiment of Figure 1, the lower support frame 20 is welded to a support base 30 which is welded at two points to the lead-in conductor 12. A respective niobium wire 32 is welded to each electrode 26 and to the lower support frame 20 as depicted in Figure 1. Respective legs of the lower support frame 20 extend into a hollow end portion of each lead-in conductor 26, to allow for expansion of the arc tube when in use, in a conventional manner. Getters 34 (only one is shown) are spotwelded to the upper support frame 22 in a known manner.

The upper support frame 22 extends into the sealed outer envelope 6 and includes a first or lower segment which is adjacent stem 8 and is electrically connected to lead-in conductor 10 by welding, and an opposite second or upper segment which is adjacent the dome 36 of the outer envelope 6. Although other known means can be provided for supporting the lower support frame 20 and the upper support frame 22 within the envelope 6, in the embodiment of Figure 1 the frames 20 and 22 are electrically connected to and mechanically supported by lead-in conductors 10 and 12 as described above.

In the preferred embodiment depicted in Figure 1, the upper segment of the upper support frame 22 includes two opposing components 38 and 40 which are electrically and mechanically connected together by means of a conventional dome support 42. In referring to Figure 1, typically the dome support is welded to the upper ends of the opposing components 38 and 40, and the components are parallel to each other.

That which has been described thus far is typical of a conventional twin are tube-type high pressure sodium lamp. The present invention provides a novel and improved connecting means for mechanically and electrically connecting upper arc tube leads to an upper support frame. For example, the present invention is useful in electrically and mechanically connecting the upper leads 28 to the upper support frame 22. It must be emphasized, however, that the new and improved connecting means is equally applicable to single tube lamps. In either case, as described in more detail herein, such a connecting means is provided which incorporates a formed piece of refractory metal or steel or stainless steel which includes one aperture therethrough for each electrode lead, each aperture being in the general form of a threadless nut configured to provide an interference fit with the typical lead such as, for example, the typical niobium sealing assembly at the end of an arc tube to provide a reliable and long lasting non-welded electrical connection as well as an improved mechanical arc tube support structure formed to provide substantial strength in

all axes. In those instances where multiple tubes are provided, the connecting means of the present invention provides improved control of arc tube to arc tube spacing within the outer envelope, improved radial positioning of the arc tubes relative to the plane of the support frame, and improved ability to withstand shock loads and vibration.

Regarding the embodiment depicted in Figure 1, the gas discharge lamp 2 includes connecting means 44 connected to each lead 28 for effecting a weldless electrical and mechanical interference fit between each lead 28 and the connecting means and for preventing axial and radial movement of each lead 28 relative to the connecting means, the connecting means also being electrically and mechanically connected to the upper segment of the upper support frame 22.

In the preferred embodiment of Figures 1 to 3, the connecting means 44 comprises a planar surface 46 having a separate aperture 48 extending therethrough for each lead 28. As depicted in Figures 1 to 3, each lead 28 extends through a respective separate aperture 48. Each aperture 48 is dimensioned for effecting an interference fit to provide a weldless electrical and mechanical connection between each lead 28 and the connecting means 44 and to prevent axial and radial movement between each lead and the connecting means. The type of interference fit contemplated herein is similar to what is known as a threadless nut. Such a nut comprises an aperture having opposing surfaces dimensioned such

that a rod inserted into the aperture initially meets resistance to insertion. Upon applying an axial force, the rod causes the opposing surfaces to spread apart sufficiently that the rod can be inserted through the aperture. However, the resistance of the opposing surfaces is such as to cause the opposing surfaces to bear against the rod with sufficient force to hold it in place relative to the nut once the rod has been inserted through the aperture. Essentially, an interference fit is provided between the rod and nut. The present invention relates to a similar fit between the arc tube lead 28 and aperture 48. Such a connection has been discovered to be satisfactory in not only providing a structural connection between arc tube electrodes and a corresponding connecting means but also in providing an improved and novel weldless electrical connection therebetween.

In the preferred embodiment, each aperture 48 comprises at least two opposing surfaces facing an axis 50 of each separate aperture 48. The distance between the opposing surfaces is selected to effect an interference fit between the leads 28 and the connecting means 44. In the embodiment of Figures 1 to 3, each separate aperture 48 comprises two pairs of opposing surfaces. In particular, aperture 48 includes a first pair formed by opposing surfaces 52 and 54 and a second pair formed by opposing surfaces 56 and 58. The distance between all adjacent opposing surfaces is equal. In the embodiment depicted in Figures 1 and 2, there is a space 60 between each adjacent surface, and each space 60 is equal

to all other spaces 60. Each space 60 is formed by opposing parallel segments 62 and 64 and a full radiused segment 66.

The connecting means depicted in the drawings include at least one leg which extends between the planar surface 46 and the upper end of the upper support frame 22 as viewed in Figure 1 to electrically and mechanically connect planar surface 46 to the upper support frame. In the preferred embodiment, a first leg 68 extends from one edge 70 of the planar surface 48 to an opposing component 38 of the upper support frame 22, and a second leg 72 extends from an opposite edge 74 of the planar surface 48 to an opposing component 40 of the upper support frame 22. The legs 68 and 72 are each disposed at an angle of about 90° relative to the planar surface as indicated at 76 with respect to leg 72. Preferably, legs 68 and 72 are integral with planar surface 46 and are formed in a conventional stamping and pressing operation. The legs 68 and 72 are welded to the components 38 and 40, respectively.

In the embodiment of Figures 1 to 3, the planar surface is in the shape of a parallelogram having two pairs of opposing corners. The leg 68 extends from one corner 78 and the leg 72 extends from an opposing corner 80. In a like manner, an aperture 48 is disposed in another corner 82 and another aperture 48 is disposed in an opposite corner 84, as depicted in Figure 2.

In the embodiment of Figures 1 to 3, each lead 28 extends through a respective, aperture 48. Opposing surfaces 52, 54, 56 and

58 of each aperture bear against a respective lead 28 for effecting a weldless electrical and mechanical interference fit between lead 28 and such opposing surfaces. In the preferred embodiment, the distance between opposing surfaces 52 and 54, and between opposing surface 56 and 58, will be slightly greater than the diameter of the lead 28. By dimensioning each aperture in this manner, when a lead is inserted therethrough the opposing surfaces will be forced slightly out of the plane of the planar surface 46, the resilience of the planar surface thereby causing such opposing surfaces to effect an interference fit similar to that of a threadless nut.

Figures 4 to 6 depict other aperture configurations, without limitation, useful in providing the interference fit of the present invention. For example, Figure 4 depicts a planar surface 86 having an aperture 88 through which a lead 28 can be caused to extend to effect the desired interference fit. In Figure 4, a plurality of slits 90 extend through the planar surface 86 adjacent to the aperture 88, the slits being oriented radially relative to a center 92 of the aperture.

Figures 5a and 5b depict a variation of the embodiment of Figure 4 in that the aperture 92′ is merely pierced through the planar surface 86′ and the radial slits 90′ merge as points at the pierced aperture 92′. Figure 5a depicts the structure without a lead extending therethrough and Figure 5b depicts the structure with a lead 28 extending therethrough. As will be the case with respect to the other embodiments discussed herein, the opposing

surfaces, formed in this embodiment by such points, extend out of the plane of the planar surface as depicted in Figure 5b to effect the desired interference fit.

In the embodiment of Figure 6, a planar surface 94 is provided having a aperture 96 extending therethrough. In this embodiment a plurality of slits 98 extend through the planar surface, the slits 98 being adjacent the aperture and oriented tangential relative to the aperture.

It will be apparent to those skilled in the art that there are many other aperture configurations other than those depicted in Figures 2 to 6 which will provide an interference fit between a lead such as lead 28 and a connecting means such as the planar surface 48, and the present invention is therefore not limited to the configuration described and depicted herein. What is required, however, is that the connecting means be dimensioned and configured as described herein to provide and interference fit such as, for example, the type provided by a threadless nut. In essence, the interference fit must effect a weldless electrical and mechanical connection between the arc tube lead and the connecting means and prevent axial and radial movement of the lead relative to the connecting means which would adversely affect the usefulness of a lamp containing such an arc tube.

The embodiments which have been described herein are but some of several which utilize this invention and are set forth here by way of illustration but not of limitation. It is apparent that many other embodiments which will be readily apparent to those skilled in the art may be made without departing materially from the spirit and scope of this invention.

I claim:

1. A gas discharge lamp, comprising:

a base;

a sealed outer envelope connected to said base;

a pair of lead-in conductors extending from said base into said sealed envelope;

at least one arc tube disposed within said sealed outer envelope, each arc tube of said at least one arc tube having a respective first lead electrically connected to one lead-in conductor of said pair of lead-in conductors and a respective second lead;

a support frame extending into said sealed outer envelope and having a first segment electrically connected to another lead-in conductor of said pair of lead-in conductors, and an opposite second segment;

connecting means connected to each second lead for effecting a weldless electrical and mechanical interference fit between each second lead and said connecting means and for preventing axial and radial movement of each second lead relative to said connecting means, said connecting means also being electrically and mechanically connected to said opposite second segment of said support frame.

2. A gas discharge lamp as described in claim 1, wherein said connecting means comprises a planar surface having a separate aperture extending therethrough for each second lead, each second

lead extending through a respective separate aperture and each separate aperture being dimensioned for effecting said weldless electrical and mechanical interference fit and preventing said axial and radial movement.

3. A gas discharge lamp as described in claim 2 wherein said connecting means comprises at least one leg extending between said planar surface and said opposite second segment of said support frame to electrically and mechanically connect said planar surface to said opposite second segment.

4. A gas discharge lamp as described in claim 2 wherein each separate aperture comprises at least two opposing surfaces facing an axis of each separate aperture, the distance between said at least two opposing surfaces being selected for effecting said weldless electrical and mechanical interference fit and preventing said axial and radial movement

5. A gas discharge lamp as described in claim 3 wherein said opposite second segment of said support frame includes two opposing components, and further wherein said at least one leg includes a first leg extending between one edge of said planar surface and one component of said two opposing components and a second leg extending between an opposite second edge of said planar surface and an opposite component of said two opposing components.

6. A gas discharge lamp as described in claim 5 wherein said first leg and said second leg is each disposed at an angle of about 90° relative to said planar surface.

7. A gas discharge lamp as described in claim 5 wherein said planar surface is in the shape of a parallelogram having two pairs of opposing corners, said first leg extending from one corner of a first pair of said two pairs of opposing corners and said second leg extending from an opposite corner of said first pair.

8. A gas discharge lamp as described in claim 7 wherein said at least one arc tube includes two arc tubes each having a respective first lead and a respective second lead, and further wherein a first separate aperture for one second lead is disposed in one corner of a second pair of said two pairs of opposing corners and a second separate aperture for another second lead is disposed in an opposite corner of said second pair.

9. A gas discharge lamp as described in claim 8 wherein said first leg and said second leg is each disposed at an angle of about 90° relative to said planar surface.

10. A gas discharge lamp as described in claim 4 wherein each separate aperture comprises two pairs of opposing surfaces, the distance between all adjacent opposing surfaces being equal.

11. A gas discharge lamp as described in claim 10 further including a respective space between each adjacent surface of said opposing surfaces.

12. A gas discharge lamp as described in claim 2 wherein a plurality of slits extend through said planar surface adjacent each respective separate aperture, said slits being oriented radially relative to a center of a respective separate aperture.

13. A gas discharge lamp as described in claim 2 wherein a plurality of slits extend through said planar surface adjacent each respective separate aperture, said slits being oriented tangential relative to a respective separate aperture.

14. A gas discharge lamp as described in claim 1 wherein said lamp is a high pressure sodium discharge lamp.

15. A gas discharge lamp, comprising;

a base;

a sealed envelope connected to said base;

a pair of lead-in conductors electrically connected to said base and extending into said sealed envelope;

at least one arc tube disposed within said sealed envelope, each arc tube of said at least one arc tube having a respective first lead electrically connected to one lead-in conductor of said pair of lead-in conductors and a respective second lead;

a support frame extending into said sealed envelope and having a first leg electrically connected at one end thereof to another lead-in conductor of said pair of lead-in conductors and electrically and mechanically connected at an opposite other end to a second leg at least a portion of which is parallel to said first leg;

connecting means connected to each second lead for effecting a weldless electrical and mechanical interference fit between each second lead and said connecting means and for

preventing axial and radial movement of each second lead relativeto said connecting means, said connecting means also being electrically and mechanically connected to said opposite other end of said first leg and to said portion of said second leg.

16. A gas discharge lamp as described in claim 15, wherein said connecting means comprises a planar surface having a separate aperture extending therethrough for each second lead, each second lead extending through a respective separate aperture and each separate aperture being dimensioned for effecting said weldless electrical and mechanical interference fit and preventing axial and radial movement,

17. A gas discharge lamp is described in claim 16 wherein said connecting means comprises a first segment which extends between an edge of said planar surface and said opposite other end of said first leg and a second segment which extends between an opposite edge of said planar surface and said portion of said second leg.

18. A gas discharge lamp as described in claim 17 wherein said at least one arc tube comprises two parallel arc tubes each of which has a respective second lead which extends through a respective separate aperture.

19. A gas discharge lamp as described in claim 18 wherein each separate aperture comprises two pairs of opposing surfaces, the distance between all adjacent opposing surfaces being equal, and further including a respective space between each adjacent surface of said opposing surfaces.

20. A gas discharge lamp as described in claim 19 wherein said lamp is a high pressure sodium discharge lamp.

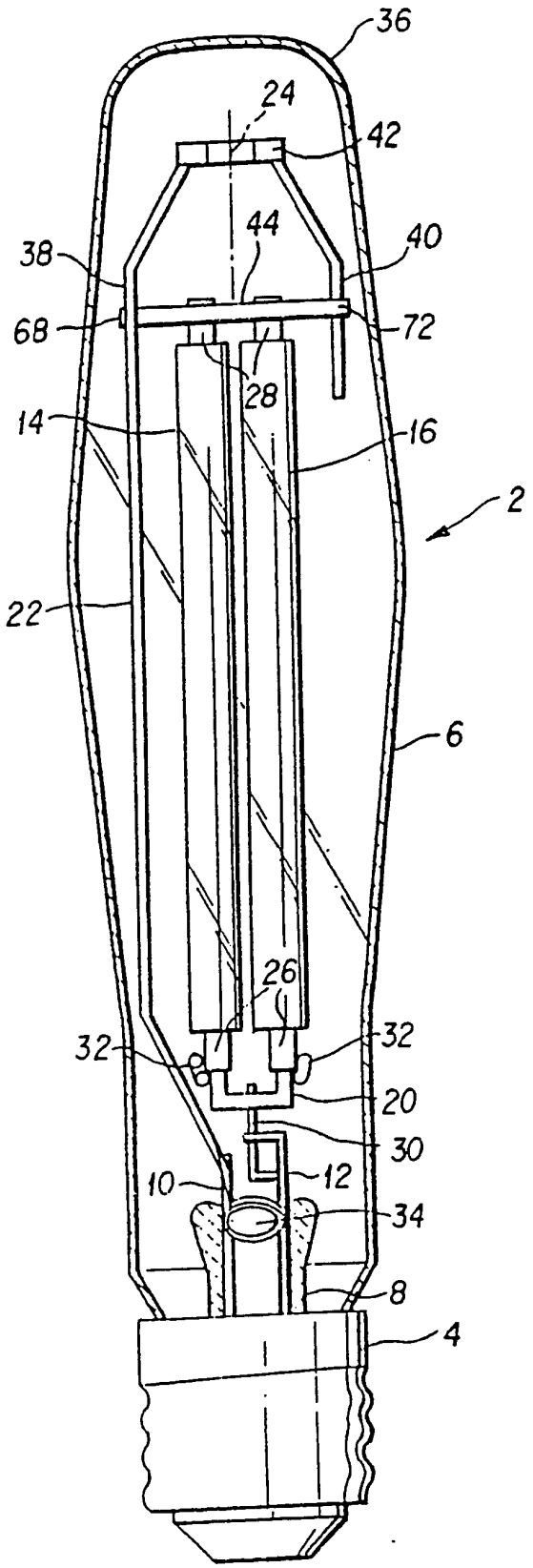

FIG. 1

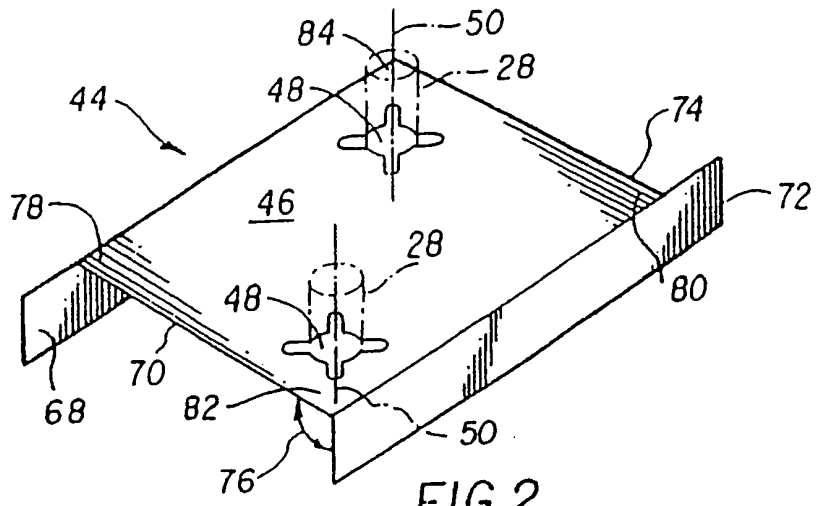

FIG. 2

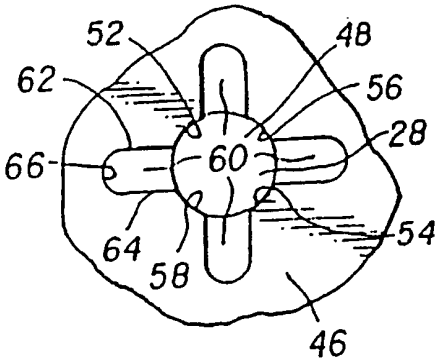

FIG. 3

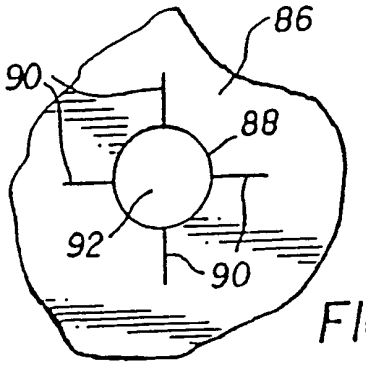

FIG. 4

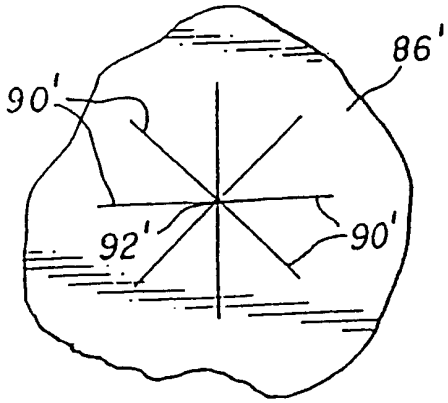

FIG. 5a

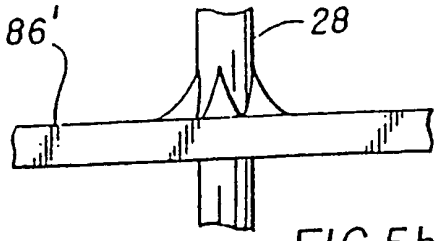

FIG. 5b

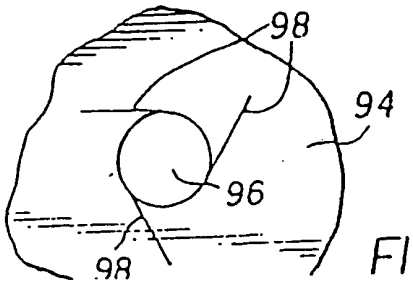

FIG 6

INTERNATIONAL SEARCH REPORT

International Application No PCT/US 90/07580

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC[5]: H 01 J 61/34

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC[5]	H 01 J 61/00,H 01 J 1/00,H 01 J 5/00,H 01 J 9/00

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [10]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
A	US, A, 4 689 518 (KING) 25 August 1987 (25.08.87), see fig. 1,5; claims 1-3 (cited in the application). --	1,15
A	EP, A2, 0 316 617 (PATENT-TREUHAND GES. für ELEKTRISCHE GLÜHLAMPEN) 24 May 1989 (24.05.89), see fig. 2,3; column 3, lines 31 -58; column 4, lines 47-56. --	1,15
P,A	US, A, 4 906 887 (SCHOLZ et al.) 06 March 1990 (06.03.90), see fig. 1,2; claims. ----	1,15

* Special categories of cited documents: [14]

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
11 April 1991 (11.04.91)	13. 05. 91
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	miss T. MORTENSEN

zum internationalen Recherchenbericht über die internationale Patentanmeldung Nr.

to the International Search Report to the International Patent Application No.

au rapport de recherche international relatif à la demande de brevet international n°

SA43916

US9007580

In diesem Anhang sind die Mitglieder der Patentfamilien der im obengenannten internationalen Recherchenbericht angeführten Patentdokumente angegeben. Diese Angaben dienen nur zur Unterrichtung und erfolgen ohne Gewähr.

This Annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The Office is in no way liable for these particulars which are given merely for the purpose of information.

La présente annexe indique les membres de la famille de brevets relatifs aux documents de brevets cités dans le rapport de recherche international visée ci-dessus. Les renseignements fournis sont donnés à titre indicatif et n'engagent pas la responsibilité de l'Office.

Im Recherchenbericht angeführtes Patentdokument Patent document cited in search report Document de brevet cité dans le rapport de recherche	Datum der Veröffentlichung Publication date Date de publication	Mitglied(er) der Patentfamilie Patent family member(s) Membre(s) de la famille de brevets	Datum der Veröffentlichung Publication date Date de publication
US-A - 4689518	25-08-87	CA-A1- 1260052	26-09-89
EP-A2- 316617	24-05-89	DE-A1- 3739008	24-05-89
		EP-A3- 316617	22-08-90
		US-A - 4924133	08-05-90
US-A - 4906887	06-03-90	Keine - None - Rien	